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(54) **ATTACHMENT MECHANISMS FOR COUPLING FIREARMS TO SUPPORTING STRUCTURES**

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USPC 89/40.06, 37.03, 37.04, 37.11, 37.14
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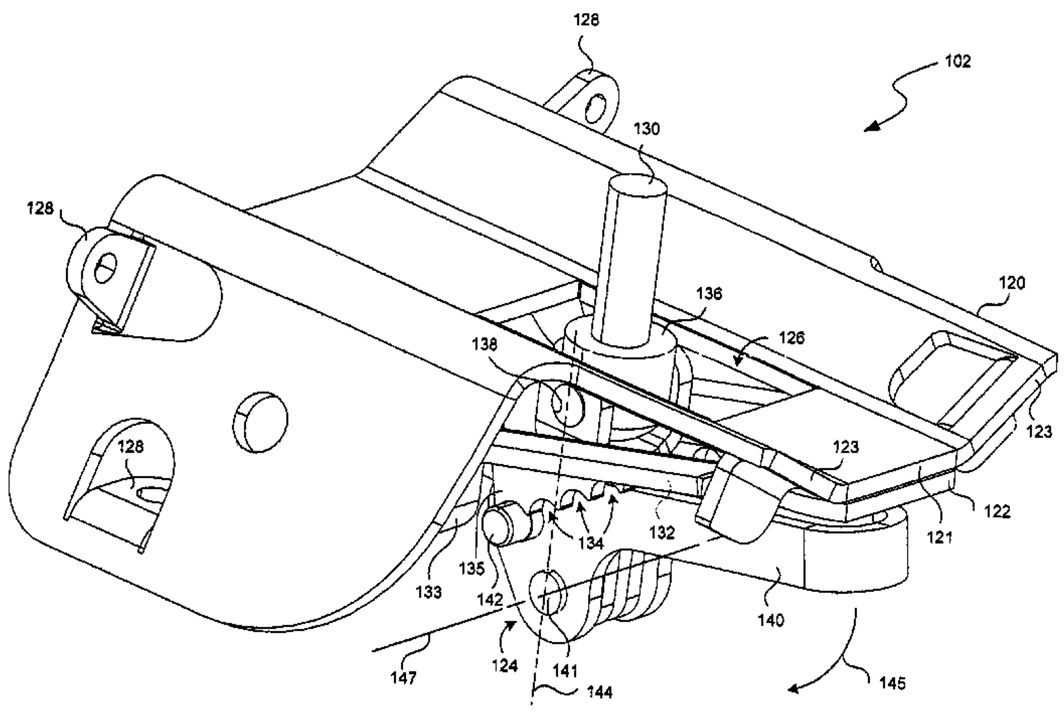
(57) **ABSTRACT**

Attachment mechanisms for attaching firearms to support structures are disclosed herein. In one embodiment, an attachment mechanism for attaching a firearm to a support structure includes an interface member coupled to a latching subassembly. The latching subassembly includes having an attachment portion and a latching arm. The attachment portion is configured to engage a connector fastened to the firearm through the aperture, and the latching arm lockably retains the attachment portion proximate to the interface member.

18 Claims, 7 Drawing Sheets



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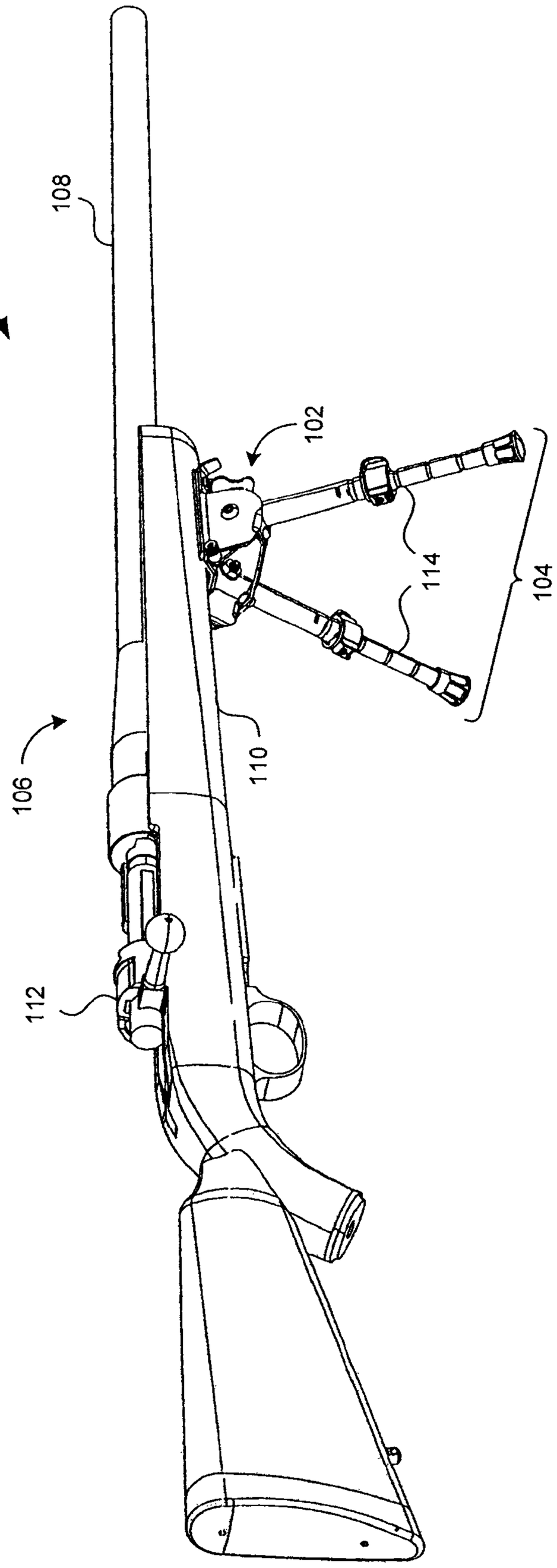

FIG. 1

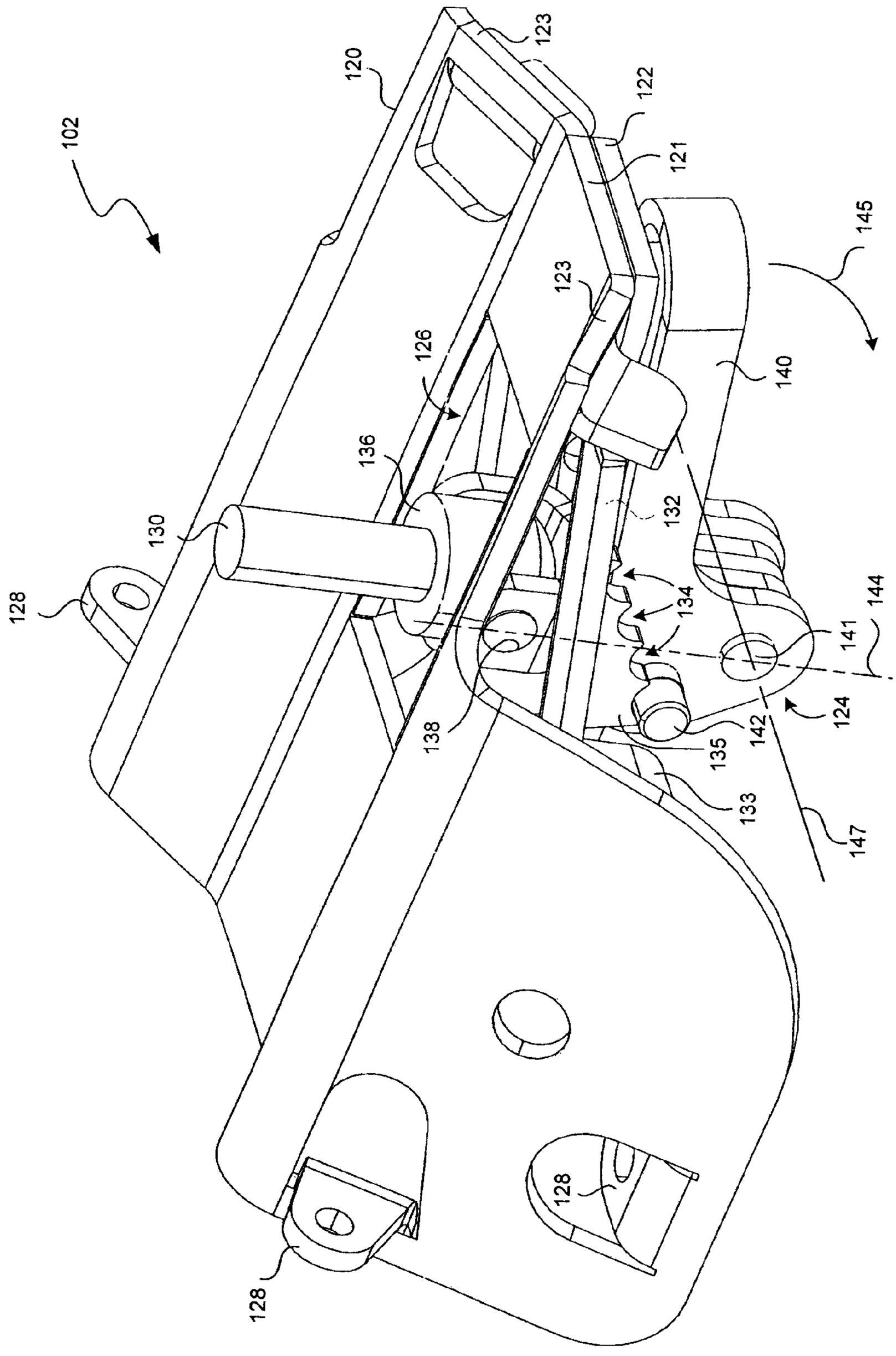
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FIG. 2

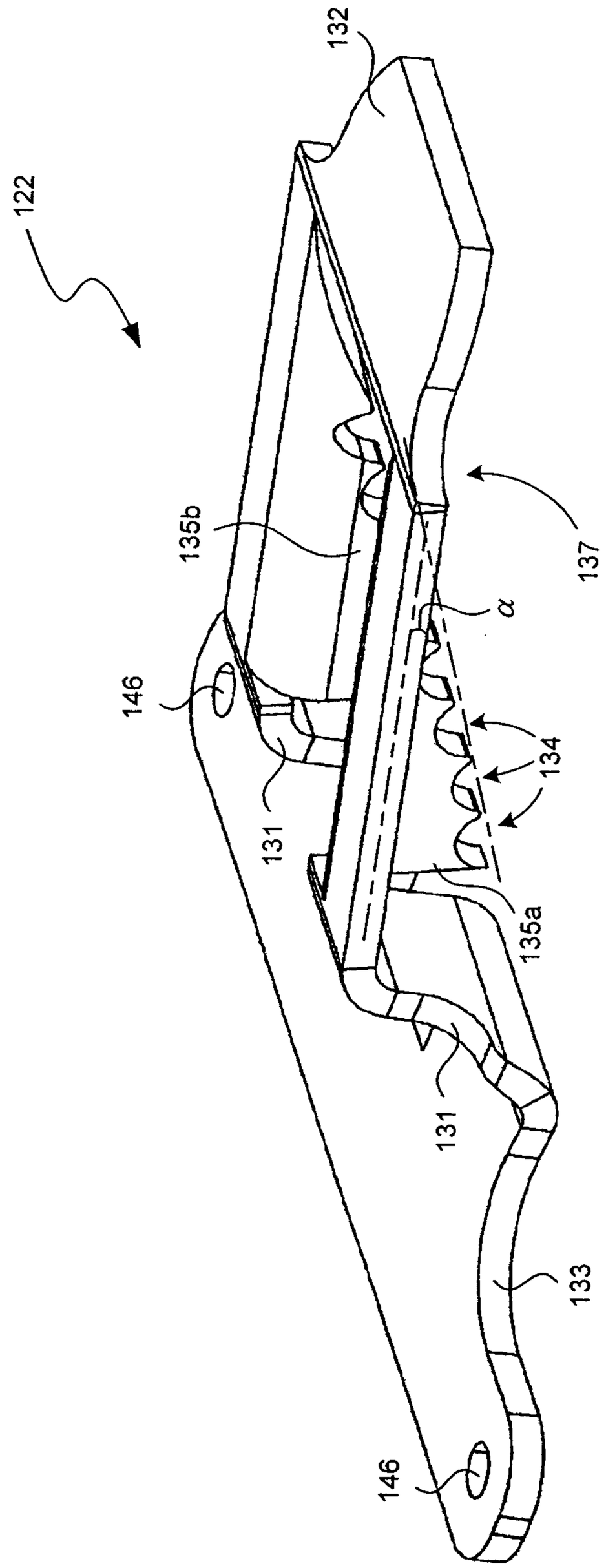

FIG. 3

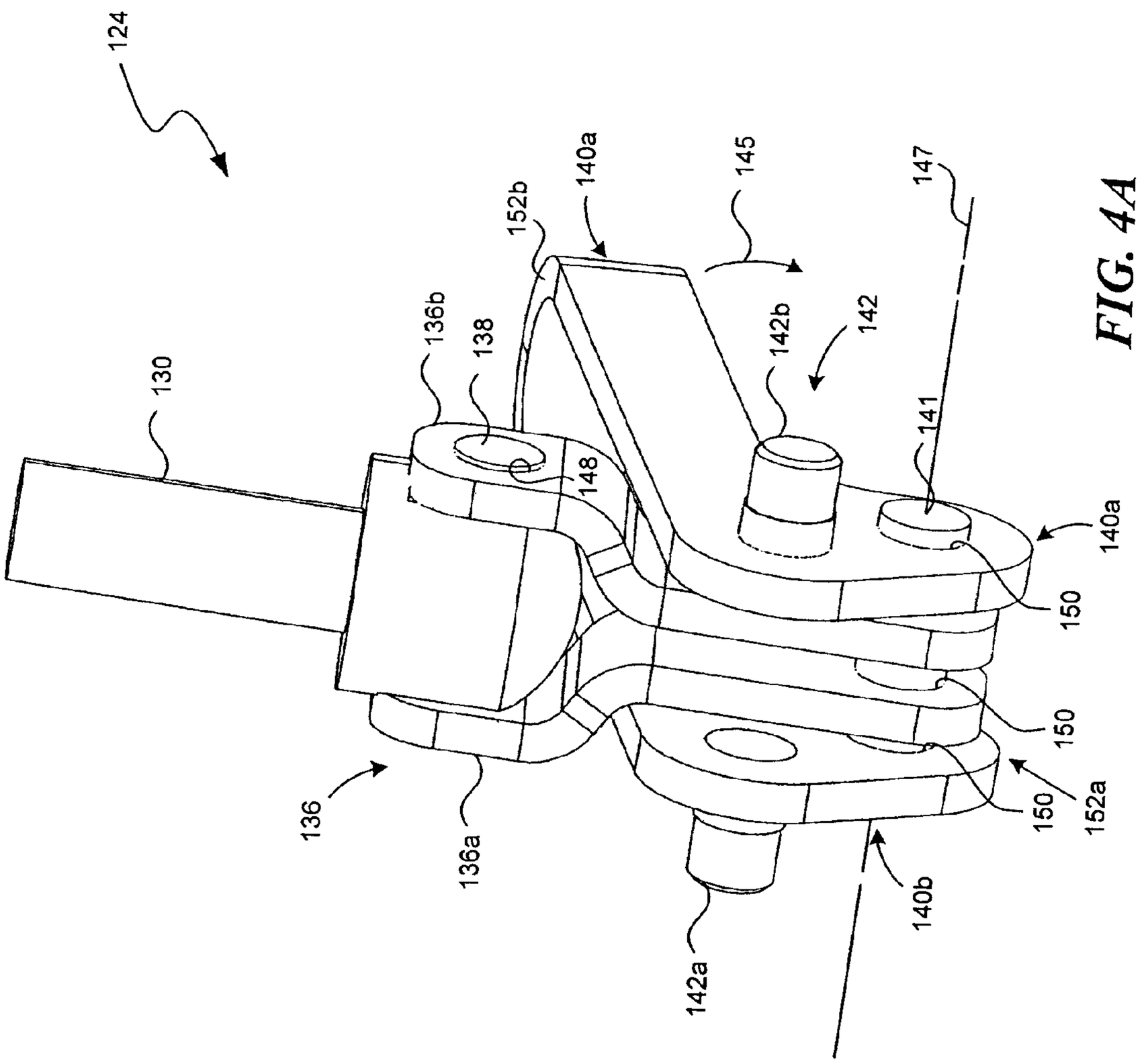
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FIG. 4A

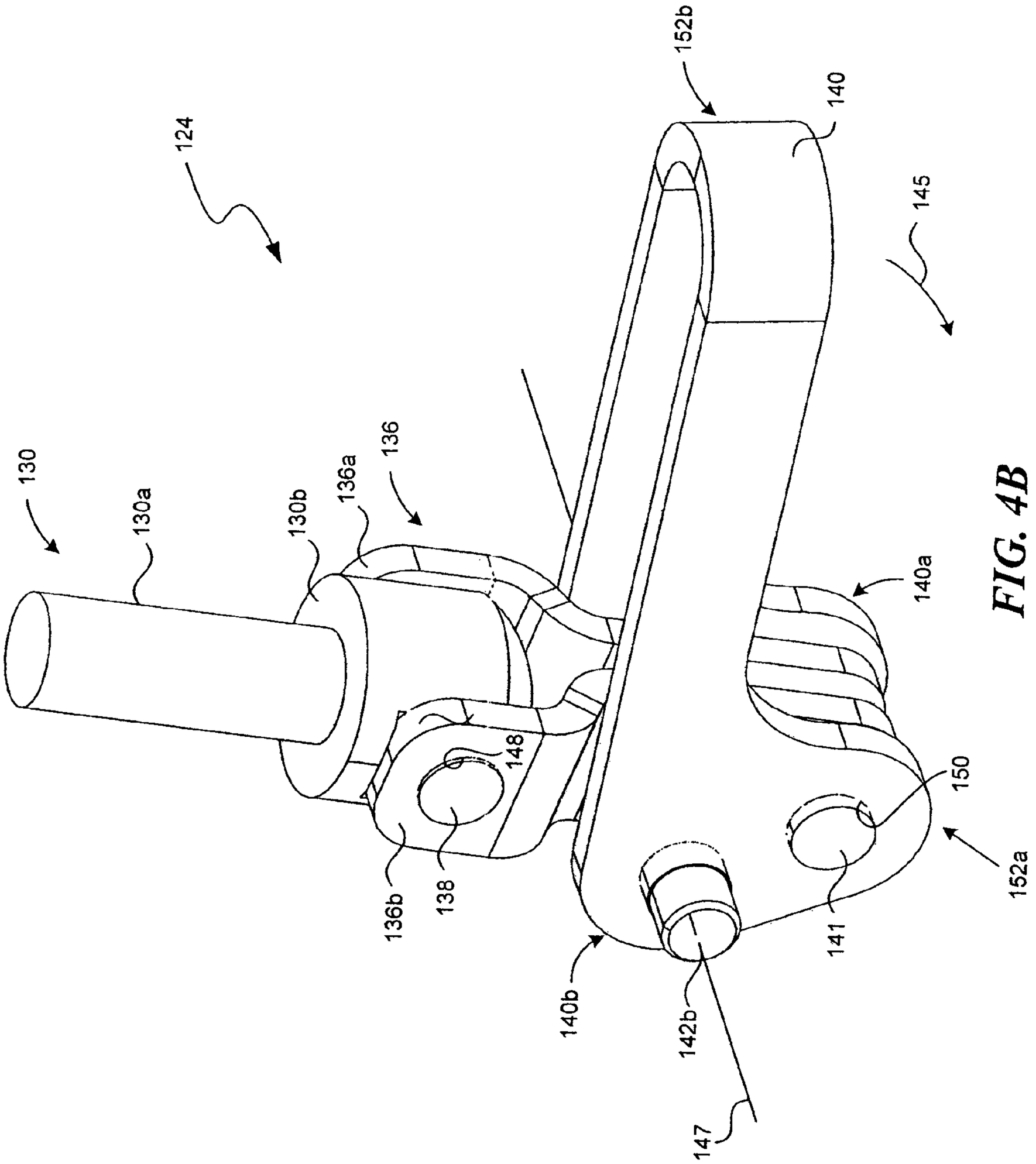
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FIG. 4B

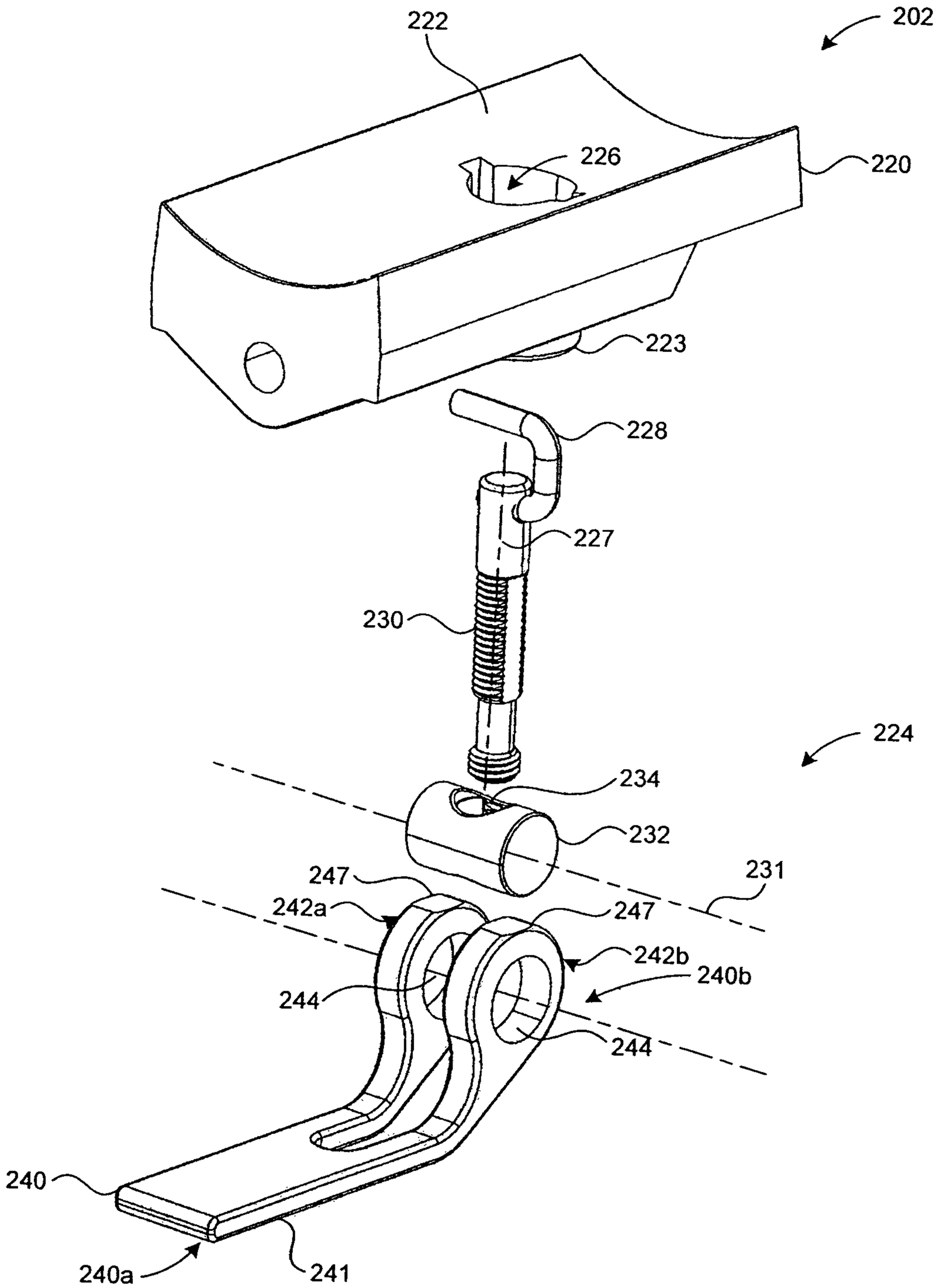
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FIG. 5A

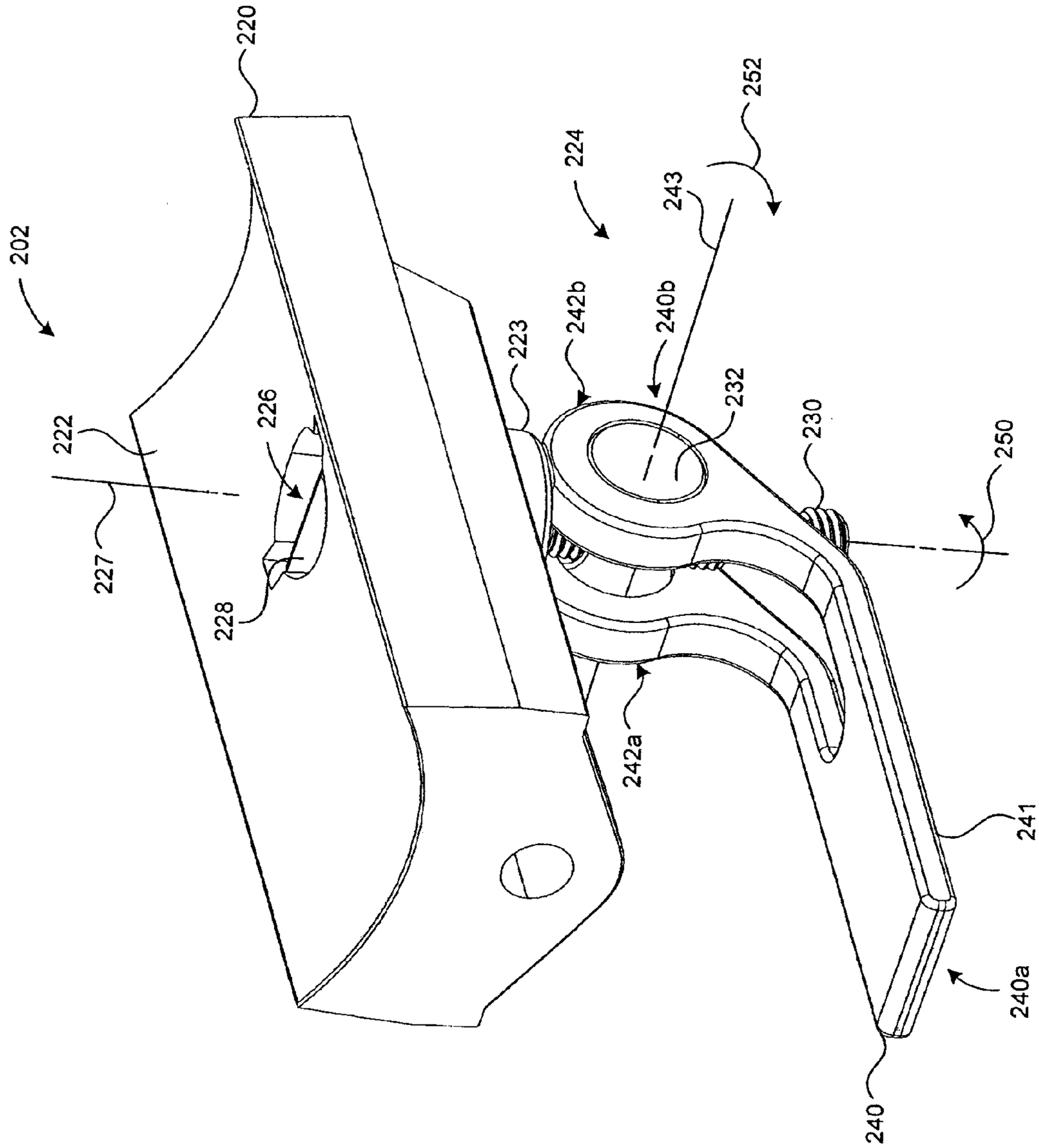
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FIG. 5B

ATTACHMENT MECHANISMS FOR COUPLING FIREARMS TO SUPPORTING STRUCTURES

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a divisional of U.S. patent application Ser. No. 12/209,113,filed Sep. 11, 2008, now U.S. Pat. No. 7,845,267, which claims priority to U.S. Provisional Application Ser. No. 60/971,507, filed Sep. 11, 2007, the disclosures of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

The present disclosure is generally related to attachment mechanisms for attaching firearms to support structures, e.g., bipods.

BACKGROUND

In recent centuries, firearms have been widely used for hunting games or waging wars. To achieve precision in using firearms, monopods, bipods, tripods, gun carriages, and/or other support structures are typically attached to firearms for providing stability during firing. However, the support structures can reduce the portability of the firearms by increasing the weight and the size of the complete assemblies. Accordingly, attachment mechanisms that can enable quick attachment/detachment of the support structures to from the firearms are needed for improved operability.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of a firearm assembly in accordance with an embodiment of the disclosure.

FIG. **2** is an isometric view of an embodiment of an attachment mechanism suitable for use in the firearm assembly of FIG. **1** in accordance with an embodiment of the disclosure.

FIG. **3** is an isometric view of an embodiment of a mounting member in FIG. **2** in accordance with an embodiment of the disclosure.

FIGS. **4**A-B are isometric views of an embodiment of a latching subassembly in FIG. **2** in accordance with an embodiment of the disclosure.

FIG. **5**A is an exploded isometric view of an embodiment of an attachment mechanism suitable for use in the firearm assembly of FIG. **1** in accordance with another embodiment of the disclosure.

FIG. **5**B is an isometric view of the attachment mechanism in FIG. **5**A as assembled in accordance with another embodiment of the disclosure.

DETAILED DESCRIPTION

Specific details of several embodiments of the disclosure are described below with reference to embodiments of an attachment mechanism for attaching a support structure (e.g., a bipod) to a firearm. The term "firearm" generally refers to a device that can discharge a projectile with a propellant (e.g., a combustion gas, compressed air, etc.) Examples of a firearm include rifles, machine guns, muskets, air rifles/pistols, etc. Several other embodiments may have different configurations, components, or procedures than those described in this section. A person of ordinary skill in the art, therefore, will accordingly understand that the disclosure may have other embodiments with additional elements, or the invention may have other embodiments without several of the elements shown and described below.

FIG. **1** is an isometric view of a firearm assembly **100** in accordance with an embodiment of the disclosure. As illustrated in FIG. **1**, the firearm assembly **100** can include a firearm **106**, a support structure **104**, and an attachment mechanism **102** connecting the support structure **104** to the firearm **106**. The firearm **106** can include a barrel **108** operatively coupled to a firing mechanism **112** (e.g., a bolt-action firing mechanism), and a stock **110** at least partially supporting and/or housing the barrel **108** and the firing mechanism **112**. The firearm **106** is generally illustrated in FIG. **1** as a rifle; however, in other embodiments, the firearm **106** can also be a handgun, a machine gun, and/or other types of firearm.

In the illustrated embodiment, the support structure **104** includes a bipod **114** extending from the stock **110** of the firearm **106**. In certain embodiments, the bipod **114** can include two cylindrical tubes constructed from a metal, a metal alloy, a polymeric material, and/or other suitable material with sufficient strength. In other embodiments, the bipod **114** can also include springs, sleeves, pivots, and/or other features for collapsing the bipod **114** for storage and/or transport. In further embodiments, the support structure **104** can also include a monopod, a tripod, a gun carriage, and/or other support devices that can provide support to the firearm during use.

The attachment mechanism **102** can be positioned between the firearm **106** and the support structure **104**. In one aspect of this embodiment, the attachment mechanism **102** can be configured to releasably attach/detach the support structure **104** to/from the firearm **106**. In another aspect of this embodiment, the attachment mechanism **102** can be configured to enable a quick release of the support structure **104** from the firearm **106** for improving operability of the firearm assembly **100**, as described in more detail below with reference to FIGS. **2**-**4**B.

Even though the firearm assembly **100** is illustrated in FIG. **1** to have particular components, in certain embodiments, the firearm assembly **100** can also include shoulder straps, telescopes, external magazines, and/or other accessories for the firearm **106**. In other embodiments, portions of the stock **110** and/or other components of the firearm assembly **100** can be different and/or omitted.

FIG. **2** is an isometric view of an embodiment of the attachment mechanism **102** in FIG. **1** in accordance with an embodiment of the disclosure. As shown in FIG. **2**, the attachment mechanism **102** can include an interface member **120**, a mounting member **122** attached to the interface member **120**, and a latching subassembly **124** movably coupled to the mounting member **122**. In the illustrated embodiment, the interface member **120** and the mounting member **122** are shown as stand-alone components couplable with fasteners (e.g., bolts and nuts). However, in certain embodiments, the interface member **120** and the mounting member **122** can be formed integrally as a single component.

The interface member **120** can include a center portion **121** and two side portions **123** extending from the center portion **121**. The center portion **121** and the side portions **123** can be arranged at an angle to receive and accommodate the stock **110** (FIG. **1**). The center portion **121** can include an aperture **126** through which a connector **130** can extend to engage the stock **110**. In one embodiment, the connector **130** can include a swivel stud. In other embodiments, the connector **130** can also include a threaded stud and/or other fasteners. The side portions **123** can also include connecting features, e.g., taps **128**, for connecting to other components of the attachment

mechanism **102**, the support structure **104** (FIG. **1**), and/or other components of the firearm assembly **100** (FIG. **1**).

The mounting member **122** can include a mounting plate **132** configured to engage the center portion **121** of the interface member **120**, an anchor plate **133** configured to engage the side portions **123** of the interface member **120**, and a receiving plate **135** extending from the mounting plate **132**. The receiving plate **135** can include notches **134** and/or other engagement features for receiving the latching subassembly **124**. Embodiments of the mounting member **122** are discussed in more detail below with reference to FIG. **3**.

The latching subassembly **124** can include an attachment portion **136**, a latching arm **140** movably coupled to the attachment portion **136** by a coupling pin **141**, and a latching pin **142** extending outwardly from the latching arm **140** and resting in one of the notches **134** of the mounting member **122**. In the illustrated embodiment, the attachment portion **136** is fixedly coupled to the connector **130** with a swivel pin **138**. In other embodiments, the attachment portion **136** can be coupled to the connector **130** with a screw, a bolt, a nut, and/or other fasteners. Embodiments of the latching subassembly **124** are discussed in more detailed below with reference to FIGS. **4**A-B.

Referring to FIG. **1** and FIG. **2** together, the attachment mechanism **102** can securely hold the firearm **106** and the support structure **104** together during use.

When assembled, the connector **130** is fixedly attached to the stock **110** of the firearm **106**, and the attachment portion **136** is fixedly coupled to the connector **130**. As a result, the latching subassembly **124** can force the stock **110** toward the attachment mechanism **102** via the connector **130** until the stock **110** securely rests on the interface member **120**. Because different firearms may have different stock configurations (e.g., height, shape, etc.), a user can select one of the notches **134** that provides the required height between the latching pin **142** and the center portion **121** of the interface member **120** to securely engage the firearm **106**.

During detachment, a user can pull the latching arm **140** clockwise (as indicated by an arrow **145**) away from the mounting member **122**. As the latching arm **140** pivots around the coupling pin **141**, the latching pin **142** rotates toward an axis **144** that passes through the centers of the swivel pin **138** and the coupling pin **141**. As a result, the rotation of the latching arm **140** pulls the stock **110** toward the interface member **120** because the distance between the swivel pin **138** and the coupling pin **141** increases. As all three pins (i.e., the swivel pin **138**, the coupling pin **141**, and the latching pin **142**) are aligned along the axis **144**, the attachment mechanism **102** exerts the maximum pulling force on the stock **110**. As the user continues to pull the latching arm **140** clockwise, the latching pin **142** passes and moves away from the axis **144**. As a result, the amount of pulling force exerted on the stock **110** is reduced because the distance between the swivel pin **138** and the coupling pin **141** decreases. As the user continues to pull the latching arm **140** clockwise, the pressure between the stock **110** and the interface member **120** can be reduced or even eliminated. After the pressure is at least reduced, the user can detach the attachment mechanism **102** from the stock **110** by removing the swivel pin **138**.

FIG. **3** is an isometric view of an embodiment of the mounting member **122** in FIG. **2** in accordance with an embodiment of the disclosure. As illustrated in FIG. **3**, the mounting member **122** includes the mounting plate **132**, the anchor plate **133**, and an intermediate portion **131** connecting the mounting plate **132** and the anchor plate **133**. In the illustrated embodiment, the mounting plate **132** and the anchor plate **133** are offset from one another; however, in other embodiments, these components can be generally planar. The anchor plate **133** can include connecting features **146** (e.g., holes) for coupling to the interface member **120** (FIG. **2**) and/or other components of the attachment mechanism **102**.

The mounting plate **132** can also include an opening **137** configured to at least partially align with the aperture **126** (FIG. **2**) of the interface member **120**. The mounting member **122** also includes a first receiving plate **135***a* and a second receiving plate **135***b* having the notches **134** and extending from the mounting plate **132** along two sides of the opening **137**. As shown in FIG. **3**, the tops of the notches **134** form generally a line at an angle α with the mounting plate **132**. The angle α can be from about 5° to about 85°, preferably from about 15° to about 60°, and more preferably from about 25° to about 45°.

FIGS. **4**A-B are isometric views of an embodiment of the latching subassembly **124** in FIG. **2** in accordance with an embodiment of the disclosure. As shown in FIGS. **4**A-B, the latching subassembly **124** includes the attachment portion **136**, the latching arm **140**, and the coupling pin **141** pivotably coupling the attachment portion **136** and the latching arm **140** together.

The latching arm **140** includes first and second latching sections **140***a-b* spaced apart from one another and are eccentric relative to a latching axis **147** at a first end **152***a* proximate to the coupling pin **141**. The latching arm **140** also includes a first latching pin **142***a* and a second latching pin **142***b* extending from the first and second latching sections **140***a-b*, respectively. The first and second latching sections **140***a-b* can be joined at a second end **152***b* spaced apart from the first end **152***a*. The attachment portion **136** can include a first attachment section **136***a* and a second attachment section **136***b* spaced apart from the first attachment section **136***a* at a distance suitable for accommodating the connector **130**. Each of the first and second latching sections **140***a-b* and the first and second attachment sections **136***a-b* can include first apertures **150** that can be aligned along the latching axis **147** to allow the coupling pin **141** to extend through. The first and second attachment sections **136***a-b* can also include second apertures **148** that can be aligned to allow the swivel pin **138** to extend through. As a result, the latching arm **140** can pivot eccentrically relative to the attachment portion **136** around the latching axis **147**, as indicated by the arrow **145**.

FIG. **5**A is an exploded isometric view of an embodiment of an attachment mechanism **202** suitable for use in the firearm assembly **100** of FIG. **1** in accordance with another embodiment of the disclosure. The attachment mechanism **202** can include an interface member **220** and a latching subassembly **224** releasably coupled to the interface member **220**.

The interface member **220** can include a first surface **222** that is curved to accommodate the stock **110** (FIG. **1**) and a second surface **223** opposite the first surface **222** and proximate to the latching assembly **224**. The interface member **220** can also include an interface aperture **226** extending from the first surface **222** to the second surface **223**. As shown in FIG. **5**A, The interface aperture **226** can have a generally circular cross-section with a stepped slot that extends radially outwardly. In other embodiments, the interface aperture **226** can have other cross-section configurations to accommodate the latching subassembly **224**.

The latching subassembly **224** can include a attachment portion **228** fixedly or releasably attached to a threaded shaft **230**. As shown in FIG. **5**A, the attachment portion **228** includes a generally cylindrical bar that can engage the attachment portion **136** (FIG. **4**A) by extending through the second apertures **148** (FIG. **4**A). In other embodiments, the

attachment portion **228** can also include a pin, a screw, and/or another fastening mechanism. In the illustrated embodiment, the threaded shaft **230** extends along a shaft axis **227** and has interrupted threads. In other embodiments, the threaded shaft **230** can have non-interrupted threads and/or other configurations.

The latching subassembly **224** can also include a bushing **232** having a threaded aperture **234** to engage the threaded shaft **230**. In the illustrated embodiment, the bushing **232** has a generally cylindrical shape extending along a bushing axis **231**. The threaded aperture **234** extends through the bushing **232** generally perpendicularly relative to the bushing axis **231**. In other embodiments, the bushing **232** can having other configurations.

The latching subassembly **224** can further include a latching arm **240** releasably coupled to the bushing **232**. The latching arm **240** includes a handle **241** at a first end **240***a* and first and second forks **242***a-b* spaced apart from one another and extending from the handle **241** toward a second end **240***b* opposite the first end **240***a*. The first and second forks **242***a-b* each include a cam structure **247** having an latching aperture **244** generally aligned along a latching axis **243** to receive the bushing **232**. At least one of the cam structures **247** can be eccentric relative to the latching axis **243**.

FIG. **5**B is an isometric view of the attachment mechanism **202** in FIG. **5**A as assembled in accordance with another embodiment of the disclosure. During assembly, the attachment portion **228** can be first engaged with the attachment portion **136** (FIG. **4**A) by extending through the second apertures **148** (FIG. **4**A). Then, the interface member **220** can be positioned against the stock **110** (FIG. **1**) by having the threaded shaft **230** sliding through the interface aperture **226** until the attachment portion **228** rests on the stepped slot. Then, the threaded shaft **230** can extend through the bushing **232** that is received in the latching apertures **244** until the first and second forks **242***a-b* are proximate to the second surface **223** of the interface member **220**. The latching arm **240** can then be rotated approximately 90° around the shaft axis **227** to engage threads of the threaded shaft **230**. Then, the handle **241** can be rotated around the latching axis. As the latching arm **240** rotates, the cam structures **247** press against the second surface **223** of the interface member **220** to pull the stock **110** toward the bushing **232** in order to secure the attachment mechanism **202** to the stock **110**.

In any of the embodiments discussed above, the attachment mechanisms can allows a user to attached/detach a support structure to/from a firearm without using tools and with improved attachment security over conventional techniques. According to conventional techniques, a threaded rod is typically used to couple to a swivel stud on a gun stock. A support structure (e.g., a bipod) is then attached to the stock and tightened by running a nut against the threaded rod. However, the motion of the bipod can cause the nut to come loose over time to undermine the attachment security. One conventional method to solve this problem is using tools to tighten the nut. However, such tools may not be available in the field. Embodiments of the attachment mechanisms solved this problem by using the latching arms with cam structures that can be rotated to exert resistance to the stock so that the bipod is less likely to come loose over time.

From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the invention. Elements of one embodiment may be combined with other embodiments in addition to or in lieu of the elements of the other embodiments. Accordingly, the invention is not limited except as by the appended claims.

We claim:

1. An attachment mechanism for attaching a firearm to a support structure, comprising:

an interface member having an aperture and first side opposite a second side, wherein the first side is configured to contact the firearm; and

a latching subassembly proximate to the interface member, the latching assembly including—

an attachment portion configured to engage a connector extending from the firearm through the aperture; and

a latching arm coupled to the attachment portion and movable about a latching axis, the latching arm having an end portion including a cam structure configured to contact the second side of the interface member, and wherein the cam structure has a latching aperture through which the latching axis passes, and wherein the cam structure is at least partially eccentric relative to the latching axis.

2. The attachment mechanism of claim **1** wherein the latching arm pivots about the latching axis from an open position to a closed position to lockably engage the second side of the interface member and to secure the first side of the interface member against the firearm.

3. The attachment mechanism of claim **1** wherein the attachment portion includes a shaft having a shaft axis extending longitudinally along the shaft, wherein the shaft axis is generally perpendicular to the latching axis.

4. The attachment mechanism of claim **1** wherein the cam structure includes a first cam structure spaced apart from a second cam structure.

5. The attachment mechanism of claim **4** wherein each of the first and second cam structures includes a generally flat portion that contacts the second side of the interface member to at least partially secure the interface member against the firearm when the latching arm is in a closed position with reference to the interface member.

6. The attachment mechanism of claim **4** wherein the latching subassembly further comprises a bushing coupled to the attachment portion, wherein the bushing at least partially extends through each of the first and second cam structures.

7. The attachment mechanism of claim **6** wherein the bushing is rotatably coupled to the shaft and rotates on the shaft, and wherein the latching arm is pivotally coupled to the bushing and the cam structure rotates on the bushing.

8. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm wherein the latching arm includes a bushing opening that receives the bushing, and wherein the center of the bushing opening is eccentric with reference to the latching axis.

9. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm, wherein the latching arm includes a cam structure that rotates about the bushing, and wherein the cam structure includes a generally planar section that contacts the second surface of the interface member when the latching arm is in the closed position.

10. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm wherein the latching arm includes a first cam portion spaced apart from a second cam portion, and wherein the bushing extends laterally between the first cam portion and the second cam portion.

11. The attachment assembly of claim 10 wherein the shaft extends at least partially through the bushing in between the first cam portion and the second cam portion.

12. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft wherein the bushing includes a threaded opening that receives a threaded portion of the shaft; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm.

13. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft wherein the bushing rotates on the shaft about the longitudinal axis, and the latching arm rotates on the bushing about the latching axis; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm.

14. An attachment assembly for securing a firearm to a support structure, the attachment assembly comprising:

an interface member configured to contact the firearm, the interface member having an aperture configured to receive a connector extending from the firearm; and

a latching subassembly including—

an attachment portion configured to releasably engage the connector;

a shaft extending from the attachment portion; and

a latching arm coupled to the shaft, wherein the latching arm includes a handle at a first end portion and first and second spaced apart forks at a second end portion, and wherein the shaft extends at least partially between the first and second forks wherein the latching arm pivots about a latching axis that is generally perpendicular to the longitudinal axis of the shaft.

15. The attachment assembly of claim 14, further comprising a bushing attached to the shaft, wherein the bushing extends through each of the first and second forks.

16. The attachment assembly of claim 15 wherein the latching arm rotates on the bushing about a latching axis, and wherein each of the first and second forks is eccentric relative to the latching axis.

17. The attachment assembly of claim 14 wherein each of the first and second forks includes a generally flat portion that contacts the interface member to lock the latching subassembly when the latching arm is moved to a closed position with reference to the interface member.

18. The attachment assembly of claim 14 wherein the latching subassembly further comprises a bushing coupled to the shaft and spaced apart from the attachment portion, wherein the bushing extends through at least a portion of the first fork and the second fork.

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